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**TRANSCIVER SYSTEM INCLUDING MULTIPLE RADIO BASE STATIONS
THAT SHARE AN ANTENNA**

BACKGROUND OF THE INVENTION

5 Field of the Invention

 The present invention relates in general to the telecommunications field and, in particular, to a transceiver system that includes multiple radio base stations (RBSs) that can share an antenna even if the RBSs share a frequency band and/or even if the RBSs operate with different radio standards.

10 Description of Related Art

 It is well known when an operator places two or more RBSs in a transceiver system or adds a new RBS to the transceiver system that the operator would like to have the RBSs share the same antenna system. An example of a

traditional transceiver system with multiple RBSs that share the same antenna is briefly discussed below with respect to FIGURE 1.

Referring to FIGURE 1 (PRIOR ART), there is shown a block diagram of a traditional transceiver system 100 described in PCT Patent Application No. WO 92/12579. The traditional transceiver system 100 includes several base stations (BS1, BS2, BS3...BSn) each of which can belong to a different type of radio system such as TACS, ETACS and GSM. The base stations (BS1, BS2, BS3...BSn) are connected to a filter means 102 which in turn is connected to an antenna 104. The filter means 102 filters the TX signals that are sent over TX cables 106 from the base stations (BS1, BS2, BS3...BSn) and applies the filtered TX signals to the antenna 104. The filter means 102 also filters RX signals received by the antenna 104. The filtered RX signals are then sent to a divider unit 108. The divider unit 108 divides the filtered RX signals so that separate filtered RX signals can be sent over RX cables 110 to the base stations (BS1, BS2, BS3...BSn). A drawback of this particular transceiver system 100 is that each base station (BS1, BS2, BS3...BSn) needs to use two cables--TX cable 106 and RX cable 110--to share the antenna 104 which adds to the complexity and cost of the transceiver system 100. It should be noted that U.S. Patent No. 5,781,865 discloses a transceiver system that is similar to and has the same drawbacks as transceiver system 100. Accordingly, there is a need for a transceiver system that addresses and solves

the aforementioned drawback associated with the traditional transceiver system 100. This need and other needs are addressed by the transceiver systems of the present invention.

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BRIEF DESCRIPTION OF THE INVENTION

The present invention includes a transceiver system that has an antenna coupled to a filter configuration which is coupled to multiple radio base stations (RBSs). Each RBS uses one TX/RX cable and if needed a RX cable to connect to the filter configuration. To enable the RBSs so they can share one antenna, each RBS has a duplex filter incorporated therein. And, the filter configuration has a unique combination of diplex filter(s), duplex filter(s), part-band duplex filter(s), diplex-duplex filter(s), splitter(s) and/or low noise amplifier(s). Four exemplary embodiments of the transceiver system are described below to show how the filter configuration can be configured so as to enable the RBSs to share one antenna even if the RBSs share the same frequency band and/or even if the RBSs operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM). The present invention described herein also includes: (1) a method for constructing the transceiver system; (2) a radio base station; and (3) an antenna.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be obtained by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 (PRIOR ART) is a block diagram of a traditional transceiver system that was disclosed in PCT Patent Application No. WO 92/12579;

FIGURE 2 is a block diagram showing the basic components of a transceiver system in accordance with the present invention;

FIGURE 3A is a block diagram showing the basic components of a first embodiment of the transceiver system shown in FIGURE 2 in accordance with the present invention;

FIGURE 3B is a diagram showing exemplary frequency allocations associated with the transceiver system shown in FIGURE 3A in accordance with the present invention;

FIGURE 4A is a block diagram showing the basic components of a second embodiment of the transceiver system shown in FIGURE 2 in accordance with the present invention;

FIGURE 4B is a diagram showing exemplary frequency allocations associated with the transceiver system shown in FIGURE 4A in accordance with the present invention;

FIGURE 5A is a block diagram showing the basic components of a third embodiment of the transceiver system shown in FIGURE 2 in accordance with the present invention;

FIGURE 5B is a diagram showing exemplary frequency allocations associated with the transceiver system shown in FIGURE 5A in accordance with the present invention;

5 FIGURE 6A is a block diagram showing the basic components of a fourth embodiment of the transceiver system shown in FIGURE 2 in accordance with the present invention;

FIGURE 6B is a diagram showing exemplary frequency allocations associated with the transceiver system shown in FIGURE 6A in accordance with the present invention; and

10 FIGURE 7 is a flowchart illustrating the steps of a preferred method for constructing the transceiver system shown in FIGURES 2, 3A, 4A, 5A and 6A in accordance with the present invention.

15 **DETAILED DESCRIPTION OF THE DRAWINGS**

Referring to FIGURE 2, there is shown a block diagram that illustrates the basic components of a transceiver system 200 which has multiple RBSs (RBS1, RBS2...RBSn) that can share one antenna 202 in accordance with the present invention. As shown, the transceiver system 200 includes an antenna 202 which is coupled to a filter configuration 204 which in turn is coupled to multiple RBSs (RBS1, RBS2...RBSn). Each RBS (RBS1, RBS2...RBSn) uses one TX/RX cable 206 and if needed a RX cable 207 (see FIGURES 3A and 5A) to connect to the filter configuration 204. To enable the RBSs (RBS1, RBS2...RBSn) so they can share one antenna 202, each RBS (RBS1, RBS2...RBSn) has a duplex filter 208 incorporated therein. And, the filter configuration 204

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has a unique combination of duplex filter(s), duplex filter(s), part-band duplex filter(s), duplex-duplex filter(s), splitter(s) and/or low noise amplifier LNA(s). Four different examples of how the filter configuration 204 can be configured so as to enable the RBSs (RBS1, RBS2...RBSn) to share one antenna 202 even if the RBSs (RBS1, RBS2...RBSn) share the same frequency band and/or even if the RBSs (RBS1, RBS2...RBSn) operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM) are described below with respect to FIGURES 3-6.

Referring to FIGURES 3A and 3B, there are shown two diagrams associated with the first embodiment of the transceiver system 200a in accordance with the present invention. As shown in FIGURE 3A, each of the RBSs (RBS1, RBS2...RBSn) have two branches (branch A and branch B). This is done since the transceiver system 200a typically has three sectors and each sector normally has two separate antennas 202a' and 202a'' with two separate RX branches so as to obtain the proper "RX diversity gain". The need for "RX diversity gain" comes from the fact that in nature a radio signal "bounces" on different things (e.g., buildings, mountains) and this leads to problematical multipath fading. And, one way to lower the influence of multipath fading is to install two or more antennas 202a' and 202a''. The antennas 202a' and 202a'' can be place 3-4m apart from one another or the antennas 202a' and 202a'' can be made to have a 90° phase difference between themselves. However it should be appreciated that this

transceiver system 200a or any of the other transceiver systems described herein can also have just one branch and one antenna like was shown in transceiver system 200 (see FIGURE 2).

5 For clarity branch A of transceiver system 200a is described first and then a brief discussion is provided about branch B which has essentially the same filter configuration as branch A. As shown in FIGURE 3A, the transceiver system 200a includes an antenna 202a' which is
10 coupled to a filter configuration 204a' that in turn is coupled to branch A of multiple RBSs (RBS1, RBS2...RBSn). Each RBS (RBS1, RBS2...RBSn) uses one TX/RX cable 206a and if needed one RX cable 207a to connect to the filter configuration 204a'. To enable the RBSs (RBS1,
15 RBS2...RBSn) so they can share one antenna 202a', each RBS (RBS1, RBS2...RBSn) has a duplex filter 208a incorporated therein. And, the filter configuration 204a' has a unique configuration which in this embodiment includes a duplex filter 302, one or more duplex filters 304 and 305 and a
20 splitter 306. A detailed discussion is provided next on how the filter configuration 204a' is configured so as to enable the RBSs (RBS1, RBS2...RBSn) to share one antenna 202a' even if the RBSs (RBS1, RBS2...RBSn) share the same frequency band and/or even if the RBSs (RBS1, RBS2...RBSn)
25 operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM).

Referring to the filter components associated with RBS1 and RBS2 shown in transceiver system 200a, the filter

configuration 204a' includes the diplex filter 302, the
duplex filter 304 and the splitter 306. The diplex filter
302 includes a full-band receiver (RX) filter 308 and two
part-band transceiver (TX) filters 310 and 312. As can be
5 seen, the full-band RX filter 308 is coupled to part-band
TX1 filter 310. The duplex filter 304 includes a RX filter
314 and a TX filter 316. The TX filter 316 is coupled to
the part-band TX2 filter 312 located in the diplex filter
302. The first RBS1 and in particular the duplex filter
10 208a incorporated therein uses a TX/RX cable 206a to
connect to the full-band RX filter 308 and first part-band
TX1 filter 310 in the diplex filter 302. In addition, the
first RBS1 also includes a LNA 318 and a coupler 320 that
interfaces with the splitter 306 via the RX cable 207a. In
15 this way, the splitter 306 can couple a RX signal received
from the full-band RX filter 308 in the diplex filter 302
to the RX filter 314 in the duplex filter 304. It should
be appreciated that the splitter 306 is used if more than
one RBS is co-sited in the transceiver system 200a. The
20 second RBS2 and in particular the duplex filter 208a
incorporated therein uses a TX/RX cable 206a to connect to
the duplex filter 304. The RBS2 also includes a LNA 318.
In view of this filter configuration, RBS1 can receive a RX
signal applied to the antenna 202a' by way of the splitter
25 306 and transmit a TX signal within a TX1 band using the
antenna 202a'. Whereas, RBS2 can receive a RX signal
applied to the antenna 202a' and transmit a TX signal
within a TX2 band using the antenna 202a'.

For each RBS in addition to RBS1 and RBS2 that is within or added to the transceiver system 200a, the filter configuration 204a' and in particular the duplex filter 302 would include another part-band transceiver (TX) filter 322 (shown as TX3 filter 322). The part-band TX3 filter 322 is coupled to the antenna 202a'. The filter configuration 204a' would also include another duplex filter 305. The duplex filter 305 includes a RX filter 324 and a TX filter 326. The TX filter 326 is coupled to the part-band TX3 filter 322 in the duplex filter 302. The additional RBS (shown as RBSn) and in particular the duplex filter 208a incorporated therein uses a TX/RX cable 206a to connect to the duplex filter 305. The RBSn also includes a LNA 318. In view of this filter configuration, RBSn can receive a RX signal applied to the antenna 202a' by way of the splitter 306 and transmit a TX signal within a TX3 band using the antenna 202a'. The same filter scheme associated with filter configuration 204a' is used to make filter configuration 204a'' which is associated with branch B of the RBSs (RBS1, RBS2...RBSn) that share antenna 202a''.

Referring to FIGURE 3B, there is a diagram showing exemplary frequency allocations for each of the antennas 202a' and 202a'' in transceiver system 200a. It is possible to see how the RBSs (RBS1, RBS2...RBSn) can share the same frequency band and can operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM) simply by selecting the appropriate RX and TX filters. For instance, it can be seen that RBS1 branch A can operate on one

standard using TX1 while RBS1 branch B can operate in the same or another standard using TX4. And, it can be seen that RBS1 branch A and RBS1 branch B have RX diversity because both have the same RX band. Moreover, it should be appreciated that if the RBSs (RBS1, RBS2...RBSn) use different standards then there must be guardbands in the frequency allocation to separate the TX bands otherwise there will be interactions between the TXs. These guardbands could be very narrow however there is going to be a tradeoff between insertion loss and guardband attenuation.

Referring to FIGURES 4A and 4B, there are shown two diagrams associated with the second embodiment of the transceiver system 200b in accordance with the present invention. Like in the first embodiment of the present invention, transceiver system 200b and in particular each of the RBSs (RBS1, RBS2...RBSn) have two branches (branch A and branch B). For clarity branch A of transceiver system 200b is described first and then a brief discussion is provided about branch B which has essentially the same filter configuration as branch A.

As shown in FIGURE 4A, the transceiver system 200b includes an antenna 202b' which is coupled to a filter unit 204b' that in turn is coupled to branch A of multiple RBSs (RBS1, RBS2...RBSn). Each RBS (RBS1, RBS2...RBSn) uses one TX/RX cable 206b to connect to the filter unit 204b'. To enable the RBSs (RBS1, RBS2...RBSn) so they can share one antenna 202b', each RBS (RBS1, RBS2...RBSn) has a duplex

filter 208b incorporated therein. And, the filter unit 204b' has a unique configuration which in this embodiment includes a part-band duplex filter 402. A detailed discussion is provided next on how the filter unit 204b' is configured so as to enable the RBSs (RBS1, RBS2...RBSn) to share one antenna 202b' even if the RBSs (RBS1, RBS2...RBSn) share the same frequency band and/or even if the RBSs (RBS1, RBS2...RBSn) operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM).

Referring to the filter components associated with RBS1 and RBS2 shown in transceiver system 200b, the filter unit 204b' includes the part-band duplex filter 402 which is coupled to the antenna 202b'. The part-band duplex filter 402 includes two part-band receiver (RX) filters 404 and 406 and two part-band transceiver (TX) filters 408 and 410. As can be seen, the first part-band RX1 filter 404 is coupled to the first part-band TX1 filter 408. And, the second part-band RX2 filter 406 is coupled to the second part-band TX2 filter 410. The first RBS1 and in particular the duplex filter 208b incorporated therein uses a TX/RX cable 206b to connect to the first part-band RX1 filter 404 and first part-band TX1 filter 408 in the part-band duplex filter 402. In addition, the first RBS1 also includes a LNA 412 which is coupled to the duplex filter 208b. The second RBS2 and in particular the duplex filter 208b incorporated therein uses a TX/RX cable 206b to connect to the second part-band RX2 filter 406 and second part-band TX2 filter 410 in the part-band duplex filter 402. The

second RBS2 also includes a LNA 412 which is coupled to the duplex filter 208b. In view of this filter unit, RBS1 can receive a RX signal within a RX1 band that is applied to the antenna 202b' and transmit a TX signal within a TX1 band using the antenna 202b'. Whereas, RBS2 can receive a RX signal within a RX2 band that is applied to the antenna 202b' and transmit a TX signal within a TX2 band using the antenna 202b'.

For each RBS in addition to RBS1 and RBS2 that is within or added to the transceiver system 200b, the filter unit 204b' and in particular the part-band duplex filter 402 would include another part-band receiver (RX) filter 414 (shown as RX3 filter 414) and another part-band transceiver (TX) filter 416 (shown as TX3 filter 416). The part-band RX3 filter 414 is coupled to part-band TX3 filter 416. The additional RBS (shown as RBSn) and in particular the duplex filter 208b incorporated therein uses a TX/RX cable 206b to connect to the part-band RX3 filter 414 and part-band TX3 filter 416 in the part-band duplex filter 402. In addition, the RBSn also includes a LNA 412 which is coupled to the duplex filter 208b. The same filter scheme associated with filter unit 204b' is used make filter unit 204b'' which is associated with branch B of the RBSs (RBS1, RBS2...RBSn) that share antenna 202b''.

Referring to FIGURE 4B, there is a diagram showing exemplary frequency allocations for each of the antennas 202b' and 202b'' in transceiver system 200b. It is possible to see how the RBSs (RBS1, RBS2...RBSn) can share

the same frequency band and can operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM) simply by selecting the appropriate RX and TX filters. For instance, it can be seen that RBS2 branch A can operate on one standard using TX2 while RBS2 branch B can operate in the same or another standard using TX5. And, it can be seen that RBS2 branch A and RBS2 branch B do not have RX diversity because both have different RX bands where RX2 does not match RX5.

Referring to FIGURES 5A and 5B, there are shown two diagrams associated with the third embodiment of the transceiver system 200c in accordance with the present invention. Like in the first two embodiments of the present invention, transceiver system 200c and in particular each of the RBSs (RBS1, RBS2...RBSn) have two branches (branch A and branch B). For clarity branch A of transceiver system 200c is described first and then a brief discussion is provided about branch B which has essentially the same filter unit as branch A.

As shown in FIGURE 5A, the transceiver system 200c includes an antenna 202c' which is coupled to a filter configuration 204c' that in turn is coupled to branch A of multiple RBSs (RBS1, RBS2...RBSn). Each RBS (RBS1, RBS2...RBSn) uses a TX/RX cable 206c and if needed one RX cable 207c to connect to the filter configuration 204c'. To enable the RBSs (RBS1, RBS2...RBSn) so they can share one antenna 202c', each RBS (RBS1, RBS2...RBSn) has a duplex filter 208c incorporated therein. And, the filter

configuration 204c' has a unique configuration which in this embodiment includes a diplex-duplex filter 502 and may have a splitter 504 (if there are more than one cosited RBS). A detailed discussion is provided next on how the filter configuration 204c' is configured so as to enable the RBSs (RBS1, RBS2...RBSn) to share one antenna 202c' even if the RBSs (RBS1, RBS2...RBSn) share the same frequency band and/or even if the RBSs (RBS1, RBS2...RBSn) operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM).

Referring to the filter components associated with RBS1 and RBS2 shown in the transceiver system 200c, the filter configuration 204c' includes the diplex-duplex filter 502 and the splitter 504. The diplex-duplex filter 502 includes two full-band receiver (RX) filters 506 and 508 and two part-band transceiver (TX) filters 510 and 512. As can be seen, the first full-band RX filter 506 is coupled to the first part-band TX1 filter 510. And, the second full-band RX filter 508 is coupled to the second part-band TX2 filter 512 but is not coupled to the antenna 202c'. The first RBS1 and in particular the duplex filter 208c incorporated therein uses a TX/RX cable 206c to connect to the full-band RX filter 506 and first part-band TX1 filter 510 in the diplex-duplex filter 502. In addition, the first RBS1 also includes a low noise amplifier (LNA) 514 and a coupler 516 that interfaces with the splitter 504 via the RX cable 207c. In this way, the splitter 504 can couple a RX signal received from the full-

band RX filter 506 in diplex-duplex filter 502 to the RX filter 508 in diplex-duplex filter 502. The second RBS2 and in particular the duplex filter 208c incorporated therein uses a TX/RX cable 206c to connect to the second full-band RX filter 508 and second part-band TX2 filter 512 in the diplex-duplex filter 502. The second RBS2 also includes a LNA 514. In view of this filter unit, RBS1 can receive a RX signal applied to the antenna 202c' and transmit a TX signal within a TX1 band using the antenna 202c'. Whereas, RBS2 can receive a RX signal applied to the antenna 202c' by way of the splitter 504 and transmit a TX signal within a TX2 band using the antenna 202c'.

For each RBS in addition to RBS1 and RBS2 that is within or added to the transceiver system 200c, the filter configuration 204c' and in particular the diplex-duplex filter 502 would include another full-band receiver (RX) filter 518 (shown as RX filter 518) and another part-band transceiver (TX) filter 520 (shown as TX3 filter 520). The full-band RX filter 518 is coupled to part-band TX3 filter 520 but is not coupled to the antenna 202c'. The additional RBS (shown as RBSn) and in particular the duplex filter 208c incorporated therein uses a TX/RX cable 206c to connect to the diplex-duplex filter 502. The RBSn also includes a LNA 514. In view of this filter unit, RBSn can receive a RX signal applied to the antenna 202c' by way of the splitter 504 and transmit a TX signal within a TX3 band using the antenna 202c'. The same filter scheme associated with filter configuration 204c' is used to make filter

configuration 204c'' which is associated with branch B of the RBSs (RBS1, RBS2...RBSn) that share antenna 202c''.

Referring to FIGURE 5B, there is a diagram showing exemplary frequency allocations for each of the antennas 202c' and 202c'' in transceiver system 200c. It is possible to see how the RBSs (RBS1, RBS2...RBSn) can share the same frequency band and can operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM) simply by selecting the appropriate RX and TX filters. For instance, it can be seen that RBS1 branch A can operate on one standard using TX1 while RBS1 branch B can operate on the same or another standard using TX4. And, it can be seen that RBS1 branch A and RBS1 branch B have RX diversity because both have the same RX band. It can be seen that RBS2 can work in the adjacent band with a different standard.

In comparing transceiver systems 200a and 200c, it should be noted that transceiver system 200c has a lower insertion loss (~1dB) than transceiver system 200a. Because, the TX signals transmitted from the RBS2s pass through one filter 512 in the transceiver system 200c and pass through two TX filters 312 and 316 in the transceiver system 200a. Also, it should be noted that transceiver system 200c uses one diplex-duplex filter 502 while transceiver system 200a uses a diplex filter 302 and a separate duplex filter 304 per branch.

Referring to FIGURES 6A and 6B, there are shown two diagrams associated with the fourth embodiment of the

transceiver system 200d in accordance with the present invention. Like in the first three embodiments of the present invention, transceiver system 200d and in particular each of the RBSs (RBS1, RBS2...RBSn) have two
5 branches (branch A and branch B). For clarity branch A of transceiver system 200d is described first and then a brief discussion is provided about branch B which has essentially the same filter unit as branch A.

As shown in FIGURE 6A, the transceiver system 200d
10 includes an antenna 202d' which is coupled to a filter unit 204d' that in turn is coupled to branch A of multiple RBSs (RBS1, RBS2...RBSn). Each RBS (RBS1, RBS2...RBSn) uses a TX/RX cable 206d to connect to the filter unit 204d'. To enable the RBSs (RBS1, RBS2...RBSn) so they can share one
15 antenna 202d', each RBS (RBS1, RBS2...RBSn) has a duplex filter 208d incorporated therein. And, the filter unit 204d' has a unique configuration which in this embodiment includes a diplex-duplex filter 602 and may have a low noise amplifier (LNA) 604 with a splitter function. A
20 detailed discussion is provided next on how the filter unit 204d' is configured so as to enable the RBSs (RBS1, RBS2...RBSn) to share one antenna 202d' even if the RBSs (RBS1, RBS2...RBSn) share the same frequency band and/or even if the RBSs (RBS1, RBS2...RBSn) operate with different
25 radio standards (e.g., TDMA, CDMA, WCDMA and GSM).

Referring to the filter components associated with RBS1 and RBS2 shown in the transceiver system 200d, the filter unit 204d' includes the diplex-duplex filter 602,

the LNA 604 and a splitter function. The duplex-duplex filter 602 includes two full-band receiver (RX) filters 606 and 608 and two part-band transceiver (TX) filters 610 and 612. As can be seen, the first full-band RX filter 606 is coupled by way of the LNA 604 to the first part-band TX1 filter 610. And, the second full-band RX filter 608 is coupled to the second part-band TX2 filter 612 but is not coupled to the antenna 202d'. The first RBS1 and in particular the duplex filter 208d incorporated therein uses a TX/RX cable 206d to connect to the LNA 604 and the first part-band TX1 filter 610 in the duplex-duplex filter 602. In addition, the first RBS1 also includes a low noise amplifier (LNA) 614. The LNA 604 can couple a RX signal received from the full-band RX filter 606 in duplex-duplex filter 602 to the RX filter 608 in duplex-duplex filter 602. The second RBS2 and in particular the duplex filter 208d incorporated therein uses a TX/RX cable 206d to connect to the second full-band RX filter 608 and second part-band TX2 filter 612 in the duplex-duplex filter 602. The second RBS2 also includes a LNA 614. In view of this filter unit, RBS1 can receive a RX signal applied to the antenna 202d' by way of the LNA 604 and transmit a TX signal within a TX1 band using the antenna 202d'. Whereas, RBS2 can receive a RX signal applied to the antenna 202d' by way of the LNA 604 and transmit a TX signal within a TX2 band using the antenna 202d'.

For each RBS in addition to RBS1 and RBS2 that is within or added to the transceiver system 200d, the filter

unit 204d' and in particular the diplex-duplex filter 602 would include another full-band receiver (RX) filter 618 (shown as RX filter 618) and another part-band transceiver (TX) filter 620 (shown as TX3 filter 620). The full-band RX filter 618 is coupled to the LNA 604 and the part-band TX3 filter 620 but is not coupled to the antenna 202d'. The additional RBS (shown as RBSn) and in particular the duplex filter 208d incorporated therein uses a TX/RX cable 206d to connect to the diplex-duplex filter 602. The RBSn also includes a LNA 614. In view of this filter unit, RBSn can receive a RX signal applied to the antenna 202d' by way of the LNA 604 and transmit a TX signal within a TX3 band using the antenna 202d'. The same filter scheme associated with filter unit 204d' is used to make filter unit 204d'' which is associated with branch B of the RBSs (RBS1, RBS2...RBSn) that share antenna 202d''.

Referring to FIGURE 6B, there is a diagram showing exemplary frequency allocations for each of the antennas 202d' and 202d'' in transceiver system 200d. It is possible to see how the RBSs (RBS1, RBS2...RBSn) can share the same frequency band and can operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM) simply by selecting the appropriate RX and TX filters. For instance, it can be seen that RBS1 branch A can operate on one standard using TX1 while RBS1 branch B can operate on the same or another standard using TX4. And, it can be seen that RBS1 branch A and RBS1 branch B have RX diversity because both have the same RX band. It can be seen that

RBS2 can work in the adjacent band with a different standard.

In comparing transceiver systems 200c and 200d, it is noted that transceiver system 200d does not have a coupler 516 and accompanying RX cable 207c in the RBS1 nor does it have the splitter 504 like shown in transceiver system 200c. However, the transceiver system 200d does have an additional active component LNA 604 outside of the RBSs. Moreover, the transceiver system 200d and in particular the RBS1 has a slightly worse RX performance than the RBS1 in transceiver system 200c.

It should be appreciated that in all of the filter configurations described above that a "Tower mounted amplifier" (TMA) (not shown) could be easily incorporated therein if needed. And, in FIGURES 3A and 5A where the filter configurations included a splitter there is however another way of implementing this splitting function and that is to install 2 couplers in the RBS.

It should be understood that certain details and components associated with transceiver systems 200a, 200b, 200c and 200d are well known in the industry. Therefore, for clarity, the description provided above omitted those well known details and components of the transceiver systems 200a, 200b, 200c and 200d that are not necessary to understand the present invention. Lastly, it should be understood that a diplex filter normally filters signals in one band (e.g., 1900 band) from another band (e.g., 800

band). And, a duplex filter filters a TX band from a RX band.

Referring to FIGURE 7, there is a flowchart illustrating the steps of a preferred method 700 for constructing the transceiver system 700 shown in FIGURES 2, 3A, 4A, 5A and 6A in accordance with the present invention. Beginning at step 702, one antenna 202 is provided for each branch of the RBSs used in the transceiver system 200. At step 704, a filter configuration 204 is provided that has a unique combination of duplex filter(s), duplex filter(s), part-band duplex filter(s), duplex-duplex filter(s), splitter(s) and/or LNA(s) (see FIGURES 3A, 4A, 5A and 6A). At step 706, at least two radio base stations RBSs (RBS1, RBS2...RBSn) are provided where each RBS (RBS1, RBS2...RBSn) has a duplex filter 208 incorporated therein. Each RBS (RBS1, RBS2...RBSn) and in particular each duplex filter 208 is coupled to the filter configuration 204 which is configured in a manner that enables all of the RBSs (RBS1, RBS2...RBSn) to share the antenna 202 even if the RBSs (RBS1, RBS2...RBSn) share a frequency band and even if the RBSs (RBS1, RBS2...RBSn) operate with different radio standards (e.g., TDMA, CDMA, WCDMA and GSM). Four exemplary configurations of the filter configuration 204 have been described above with respect to FIGURES 3-6.

Although four embodiments of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it should be understood that the invention is not limited to the

embodiments disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.